

What is claimed is:

1. An electrode element for plasma torches, in which at least one core forming the actual electrode connected as a cathode is made of a metal or a metal alloy having a smaller work function is enclosed by a shell part made of a metal or a metal alloy having a greater work function and thermal conductivity, characterized in that the boundary layer between said core surface and said shell part is formed in a graded shape of solid solutions of said two metals or metal alloys, or an intermediate layer formed from another metal or a metal alloy having a work function being greater than that of said core material forms toward said core surface and toward said shell part each with its boundary layers a graded transition.
2. An electrode element according to claim 1, characterized in that said core is formed from hafnium or a hafnium alloy.
3. An electrode element according to claim 1, characterized in that said core is formed from tungsten, zirconium or tantalum or an alloy of these elements.
4. An electrode element according to any one of the preceding claims, characterized in that said shell part is formed from copper or a copper alloy.
5. An electrode element according to any one of the preceding claims, characterized in that said intermediate layer is formed from silver or a silver alloy.
6. An electrode element according to any one of the preceding claims, characterized in that said core is formed in a rod-shaped manner with a circular cross-section.

7. An electrode element according to any one of the preceding claims, characterized in that said core is formed from a plurality of wire-shaped elements being twisted with each other.

8. An electrode element according to any one of the preceding claims, characterized in that said core comprises a star-shaped, annular cross-section or in that said cross-section is cross-shaped.

9. An electrode element according to any one of the preceding claims, characterized in that several cores being separately arranged form said electrode.

10. An electrode element according to any one of the preceding claims, characterized in that said intermediate layer is formed from a powder.

11. An electrode element according to any one of the preceding claims, characterized in that within said shell part a single-sided open cavity which is connected to a cooling is formed.

12. An electrode element according to any one of the preceding claims, characterized in that said electrode element is replaceably connected to a sleeve-shaped portion of copper.

13. A method for the production of an electrode element for plasma torches, characterized in that said electrode element is manufactured by the application of compressive forces with a shaping method and/or a joining method in the form of a sleeve-shaped part which forms a shell part and is made of a metal or a metal alloy having a higher work function and a higher thermal conductivity and electrical conductivity into which at least one core element made of a metal or a metal alloy having a lower work function which forms said electrode and is connected as a cathode has been introduced.

14. A method according to claim 13, characterized in that said electrode element is manufactured by extrusion molding or hot isostatic pressing.

15. A method according to claim 13 or claim 14, characterized in that preheating at least up to 400 °C is carried out before extrusion molding.

16. A method according to any one of claims 13 to 15, characterized in that before extrusion molding said cavity between said sleeve-shaped part and said core element is filled for the formation of said intermediate layer with another powdery metal or a metal alloy having a work function, thermal conductivity and electrical conductivity being higher than said core material.

17. A method according to any one of claims 13 to 16, characterized in that, for the formation of said one core several wire-shaped elements are twisted with each other.

18. A method according to any one of claims 13 to 17, characterized in that before extrusion molding said cavity of said core element formed in said sleeve shape is filled with a powder of a metal or a metal alloy which has a work function being higher than said core material.

19. A method according to any one of claims 13 to 18, characterized in that said shell part, said core and/or said intermediate layer form one or one common primary product each from a powder by means of a compression molding method, and said electrode element is manufactured from one primary product or several primary products by means of extrusion molding.

20. A method according to claim 13, characterized in that said primary product(s) is (are) manufactured by cold isostatic pressing.

21. A method according to any one of claims 13 to 20, characterized in that a contour is formed on the outer circumferential surface of said shell part for a positive joint with a sleeve-shaped copper part.

22. A method according to any one of claims 13 to 21, characterized in that a single-sided open cavity is formed within said shell part by means of backward extrusion.